**INTRODUCTION**

Levels of micronutrients added to fortified foods in Uganda must meet the standards set by the Uganda National Bureau of Standards (UNBS). These levels are set to significantly increase the population’s micronutrient intake of vitamin A, iron, and iodine to help reduce micronutrient deficiencies. These deficiencies can only be managed if the fortified products contain adequate micronutrient contents.

SPRING supports the UNBS in collecting and testing micronutrients in fortified foods. Traditional methods for testing vitamin A, such as high performance liquid chromatography (HPLC) and atomic absorption spectrophotometry (AS and UV-S) for iron, are expensive and time consuming to administer. The UNBS is actively searching for alternative testing methods.

Because iCheck test kits are promoted as alternative rapid methods for quantitative testing, UNBS acquired the machines and sought to independently validate the iCheck method against established methods used in Uganda. Efficient testing of food fortification improves compliance because non-conformity to standards can be remedied swiftly.

**METHODS**

We followed the manufacturer’s (BioAnalyt) testing procedures for iCheck kits and standardized protocols for the conventional methods.

1. The iCheck tests use a correction factor to adjust for the natural nutrient content of unfortified oil or flour. We tested the validity of the iCheck’s correction factor by testing unfortified samples of oil or flour that had been collected, along with fortified samples, from local manufacturers and the Ugandan market.

2. The iCheck tests use a correction factor to adjust for the natural nutrient content of unfortified oil or flour. We tested the validity of the iCheck’s correction factor by testing unfortified samples of oil or flour that had been collected, along with fortified samples, from local manufacturers and the Ugandan market.

3. For iron using AAS, we ashed 2g samples in the furnace at 540 degrees Celsius, then dissolved them in diluted hydrochloric acid. Absorption was read at a wavelength of 248.3nm.

**RESULTS**

Table 1 shows that repeatability of measuring vitamin A levels in oil was good for the iCheck test, as compared to UV-S. Table 2 shows the iCheck method has good correlation with HPLC. We calculated the average vitamin A content of unfortified wheat flour using the iCheck Fluoro to be 0.68 mg/kg. This is in line with the value of 0.65 mg/kg suggested by BioAnalyt as a correction factor. However, the content of vitamin A in fortified wheat flour tested on two separate days resulted in negative values. This is likely because the use of an appropriate “correction” factor calculated from unfortified samples

| Vitamin A | iCheck Fluoro | HPLC | Difference
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<tr>
<td>mg/kg</td>
<td>mg/kg</td>
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<td>%</td>
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<tr>
<td>Average</td>
<td>0.38</td>
<td>0.92</td>
<td>137%</td>
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<tr>
<td>Variation in results</td>
<td>9-23%</td>
<td>13%</td>
<td>7-12%</td>
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We found the average vitamin A content of unfortified wheat flour to be 0.485 mg/kg, which is lower than the recommended 0.85 mg/kg for mass flour testing with iCheck Fluoro. Table 4 shows large variations in levels of vitamin A in maize flour. We used our estimated average value of 0.485 mg/kg instead of the recommended 0.85 mg/kg because the use of the latter resulted in negative values.

We found that the use of iCheck for estimating iron content in unfortified wheat flour produced readings that estimate higher intrinsic contents of iron.

| Iron | iCheck | UV-S | Difference
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<tr>
<td>mg/kg</td>
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<tr>
<td>Average</td>
<td>41.6</td>
<td>80</td>
<td>89%</td>
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<tr>
<td>Variation in results</td>
<td>10-20%</td>
<td>7-12%</td>
<td>0.6-13%</td>
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We tested the average vitamin A content of fortified oil in a factory in Uganda.

**CONCLUSION**

- Among the kits, iCheck for iodine in salt is reliable, but expensive.
- The accuracy of the iCheck to determine vitamin A in oil appears to report lower values than the UV-S, so the test needs to be validated against HPLC.
- Vitamin A and iron in flours need further testing to resolve the variation in multiple readings as well as issues related to the use of an appropriate “correction” factor calculated from unfortified samples.
- All issues related to accuracy and correction factors must be solved before considering the continued use of iCheck equipment for these analyses.
- The information described here can be used to ensure quality control when testing the levels of iron, A, and iodine in fortified foods in Uganda as per the national standards.

**OBJECTIVES**

The USAID-funded SPRING project in Uganda compared the performance of iCheck test kits to measured levels of iron, iodine, and vitamin A in fortified food samples against the iCheck (a low-cost rapid test) and titrations with thiosulphate (the conventional method).

**Test of Iron Using iCheck Indole**

1. Tested against two methods: WFD iodine checker (a low-cost rapid test) and titrations with thiosulphate (the conventional method).
2. Dissolved 0.5g of salt in water up to 250mL. Used 5mL of this solution (1 gram equivalence) for WFD tests, and 50mL for titrations.

**Test of Salt Using iCheck Iodine**

1. Among the kits, iCheck for iodine in salt is reliable, but expensive.
2. All issues related to accuracy and correction factors must be solved before considering the continued use of iCheck equipment for these analyses.
3. The information described here can be used to ensure quality control when testing the levels of iron, A, and iodine in fortified foods in Uganda as per the national standards.